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Who Benefits from Training Courses in Germany?

Monetary Returns to Non-formal Further Education on a Segmented Labour Market

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Abstract

While many advocate 'lifelong learning' as the ideal career model, its impact on workers' lives is still partly unclear. Especially research on monetary returns to further education has yielded mixed evidence. I argue that a thorough assessment has to consider both the types of courses and the segmentation of labour markets. Using data from the German National Educational Panel Study, I test explanations of differing returns to non-formal further education in Germany, a country known for its highly segmented labour market. Results confirm that the returns to short non-formal training courses, which are the most common forms of further education in Germany, differ remarkably between types of courses and segments. Employer-mandated courses yield the highest returns, which is especially pronounced in internal labour markets. Furthermore, there are no returns on closed occupational labour markets. In occupations, where formal credentials are less important, returns to training are present. These results suggest that returns depend less on individual decisions to invest in training and more on the context. Hence, these findings go against human capital explanations and instead support implications of the Job Competition Model and Credentialism, which emphasize the importance of labour market structure.

Introduction

The importance of continuous training within employment careers grew strongly during recent decades. Rapid technological change often renders initial education and training insufficient as careers progress. Therefore, there is a growing emphasis on 'lifelong learning' as the ideal career model. Proponents of lifelong learning stress that this model benefits both employers and employees. Employer benefits have been demonstrated in previous studies, as continuous training enables the workforce to adapt to technological change and improve the firm's productivity (Zwick, 2002). Evidence about employee benefits is more mixed. Although workers increase their job security through training (Dieckhoff, 2007), the monetary returns are found to be low or non-existent in most countries (Goux and Maurin, 2000; Pischke, 2001; Dieckhoff, Jungblut and O'Connell, 2007).

A simple, yet common, interpretation of low returns to further training is that employers retain most of the increases in productivity (Hansson, 2008). Alternatively, I argue that monetary returns are likely to differ by type of training and location in the labour market. As Bills (2003) has noted, different mechanisms explain how and to what extent education affects wages. Previous

research suggests that returns depend on the type of education as well as the labour market context (Bol and van de Werfhorst, 2011; van de Werfhorst, 2011). This has so far mainly been assessed for formal and primary education. An important exception is the international comparison of returns to further training by Vogtenhuber (2015). Expanding this line of research, I argue that the returns to further training also differ within countries depending on training organization and labour market segments constituted by firms and occupations.

For this purpose, it is theoretically important to distinguish between formal and non-formal further training because of their different scopes and types of certification (Triventi and Barone, 2014). Non-formal further training is distinguished from formal further training because it does not lead to a recognized certificate such as a post-secondary degree. These courses are usually short and include computer courses, language courses, or courses introducing new products and procedures. Non-formal further education is much more common than formal further education across OECD countries (Desjardins and Rubenson, 2013). In Germany about half of adults participate in non-formal training (Bilger *et al.*, 2013). In addition, non-formal training is highly relevant for lifelong learning because access is relatively easy due to the fact that courses are flexible for work schedules and often provided by the employer directly. Therefore, I focus on non-formal further training.

In this study, I aim to show who benefits from non-formal further training in Germany. I provide a detailed assessment of both non-formal training courses and the labour market context. Germany proves to be an interesting case for this endeavour because the labour market is strongly segmented through firms and occupations. The article is structured as follows. First, I review the evidence about the returns to further training in Germany and describe the institutional setting. Then, I introduce theories about the returns to education and discuss whether they are specific to certain segments. I test the hypotheses derived from this discussion using data from the German National Educational Panel Study (NEPS). The article concludes with a discussion of the results.

Non-formal Training in Germany: Previous Research and Institutional Background

The literature on monetary returns to further training in Germany has yielded conflicting results. Pannenberg (1995) as well as Büchel and Pannenberg (2004) found that non-formal training leads to wage increases using the German Socio-Economic Panel (GSOEP). Using the same data set, Pischke (2001) as well as Jürges and Schneider (2006) showed positive, yet non-significant, effects. The latter studies applied a more sophisticated strategy to control for selection into training. Other researchers used the German Microcensus Panel (Wolter and Schiener, 2009) or the German Life History Study (Becker and Schömann, 1996) and found positive training effects on wages. In contrast to the GSOEP, the operationalization of training in these data sets also includes formal further education, which may bias returns upwards. One recent study by Görlitz (2011) used the 'WeLL' data, which links register data on wages from the federal unemployment insurance with a survey of training activities. The author addresses selection by comparing training participants to those who planned to but then did not attend. The results show a small and non-significant positive effect of non-formal further training.

A look at the distinct configuration of the German labour market and training system is important to understand the mechanisms guiding returns to further education. The largest part of education during the life course occurs before entering the labour market. The volume of training after labour market entry is comparatively low (Müller and Jacob, 2008). The German initial training system is stratified into a vocational and an academic track. The majority of students in the vocational track combine school with on-the-job training in firms and thus acquire occupation-specific skills. After graduation, these students usually work in the occupations they were trained and therefore they do not need much further training to conduct the tasks they were hired for (Haupt, 2012). For the academic track, initial, formal courses are less occupation specific, with important exceptions such as medicine and law.

Linked to the German skill formation system, collective bargaining also influences returns to non-formal training and is still comparatively high in Germany, especially in sectors where vocational education is widespread. For example, about half of the workers in production and construction are covered by collective bargaining (Amlinger and Bispinck, 2015). The agreements usually assign wages to occupations and thus generate a compressed wage structure within occupations. Some authors in the international comparative literature suggest that high collective bargaining coverage decreases the returns to training because it leaves little room for individual wage growth due to training, although the empirical evidence for this has been inconclusive (Vogtenhuber, 2015).

Given the vocational training system and the comparatively regulated wage structure in Germany, the

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overall low or non-existent returns to further training may not seem surprising. At the same time the German labour market is segmented and therefore the factors that decrease the returns do not affect all workers similarly. The degree of occupational specificity and impact of wage setting institutions differs between the segments constituted by firms and occupations (Sengenberger, 1987; Struck, 2008). In line with this perspective, Haupt (2012) found that the returns to further training differ between occupations.

Additionally, the role of firms in Germany as the main provider of adult learning is important to understand returns to further training. The German further education sector is subject to little government intervention in international comparison (Dieckhoff, 2007). This is striking given the high level of coordination in initial vocational education. Non-formal further training courses in Germany are mainly provided by firms (Bilger *et al.*, 2013). Depending on the mode of production and the sector, firms may have very different strategies of providing and rewarding training (Wotschack and Solga, 2014). Differences in returns between firms however have received little attention so far. One exception is the study by O'Connell and Byrne (2012), who tested the hypothesis that training leads to higher returns in companies that apply high-performance work practices. Yet, their data showed only weak support for this expectation in Ireland.

Overall, Germany features a wide variety of labour market contexts and is therefore a suitable case to study the relationship between labour market segmentation and returns to further training. The results can both inform the German debate and make a general contribution about the relevance of labour market structure for the returns to further training. To achieve the latter, I introduce different theories about the returns to education in the following section.

Theory: Returns to Further Training on a Segmented Labour Market

Theoretical approaches about monetary returns to education can be roughly divided into economic and sociological perspectives (Bills, 2003). For economists, training increases productivity, which leads to higher wages depending on individual bargaining power. In contrast, sociologists view training as the entry ticket to higher paid positions, whereby wages in a certain job are usually fixed through collective agreements. The mechanism that connects training and wages is promotion. While the economic approaches usually assume perfect competition on the labour market, the sociological approaches portray the labour market as segmented (van de Werfhorst, 2011).

The economic perspective is primarily rooted in Human Capital Theory (HCT), which assumes a direct effect of education and training on a worker's productivity and subsequent wages (Becker, 1975). The theory distinguishes between firm-specific and general training. Workers participating in general training receive returns because the option of applying the skills in another firm gives them a good bargaining position. Thus, firms have no incentive to invest in general training and all such courses are worker financed. In the case of firm-specific training, employers can reap all of the associated productivity gains because there is no outside option. However, workers have no incentive to invest in firm-specific training. To overcome this under-investment, employers share costs and benefits of firm-specific training with workers (Becker, 1975). Even for investment in general skills, firms still reap most productivity gains due to wage compression (Booth and Bryan, 2005). Thus, returns are expected to be lower for employer-financed courses.

Hypothesis 1: *All non-formal training courses lead to higher wages.*

Hypothesis 2: *The returns to worker-financed non-formal training courses are higher than the returns to employer-financed courses.*

In contrast to HCT, Signalling Theory assumes that education and training are signals that employers use to assess productivity because they cannot observe it directly (Spence, 1973). Thus, it may be that participation in non-formal training does not increase productivity directly but rather signals the worker's productivity. Training participation may also signal employee motivation, which may further influence employer decisions concerning pay raises. In the signalling perspective, voluntary non-formal training should yield the highest returns because it has a greater signalling value relative to other workers than mandatory training.

Hypothesis 3*: Voluntary non-formal training courses lead to higher wages than non-voluntary, non-formal training courses.*

The Job Competition Model introduced by Thurow (1975) shifts the perspective from individual investment decisions to firm-level decisions. The model assumes that productivity is mainly a property of a position and not of a worker. Workers are hired for entry-level positions and then become part of a queue for promotions within the firm. Their perceived trainability, assessed

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through educational certificates, determines their position in that queue. If a higher position becomes available, the employer selects the head of the queue and trains this worker for the new position. Consequently, there is no independent effect of training on wages but wage growth and mandatory training participation occur simultaneously or even before training takes place. The mechanism for wage growth is thus selection by the employer rather than the training itself.

Similarly in opposition to HCT, Credentialist Theory challenges the notion that education leads to higher wages because of higher productivity (Collins, 1979; Bills, 2003). Instead, educational certificates are seen as entry tickets to positions in the labour market. Returns are generated through social closure and resulting scarcity of skilled labourers. Such processes can be observed for many occupations that close themselves off from outside competition through educational certificates or licences (Weeden, 2002; Bol and Weeden, 2015).

Thus, the Job Competition Model and Credentialism stress the importance of firms and certificates for structuring job competition. This is in line with the idea that workers only compete for jobs within segments. In Germany, Sengenberger (1987) distinguishes between firm internal labour market (ILM), occupational labour market (OLM), and the unstructured or secondary labour market. ILMs are characterized by careers within large firms, i.e. job competition takes place within the firm. In OLMs, workers have occupation-specific skills and credentials. Thus, they compete for jobs across firms within an occupation. In the unstructured labour market finally, workers face competition from all other workers in that market. Each of these labour markets leads to different career mobility patterns (Blossfeld and Mayer, 1988). In a recent extension of this framework, Köhler *et al.* (2008) further separate ILMs and OLMs into a primary and a secondary segment. The primary sector offers high wages and employment security for both ILMs and OLMs. Employment security is still high on secondary ILMs albeit with lower wages and little career options. Hence, not all firms that have ILMs also provide career options. Finally, secondary OLMs are characterized by both employment insecurity and low wages.

These considerations suggest that the Job Competition Model describes the returns to training within an ILM, since it refers to internal careers where training and promotions are tightly coupled. The classification of segments by Köhler *et al.* (2008) suggests that these mechanisms might be especially relevant in primary ILMs. OLMs, on the other hand, go together with Credentialism, since access to them is restricted to workers with occupation-specific credentials. Therefore, formal educational degrees are most important for employment careers in OLMs, and non-formal training courses have no effect on wages (Haupt, 2012). Hence, the mechanisms that the Job Competition Model and Credentialism propose are segment specific.

Hypothesis 4*: Mandatory, non-formal further training is associated with wage growth in companies with a primary ILM.*

Hypothesis 5*: In the case of promotions, mandatory, non-formal training courses occur after wage growth.*

Hypothesis 6*: Non-formal training has no effects on wages on OLMs*

Data and Methods

To test the expectations, I use data from starting cohort 6 of the NEPS (SUF 6.0.1) (Allmendinger *et al.*, 2011; Blossfeld, Roßbach and von Maurice, 2011). The data set comprises a sample of German residents born between 1956 and 1986. Five waves of the panel are currently available.[1] I constructed a data set consisting of individuals who were in dependent employment for at least two consecutive waves and had no missing information on used variables. This yielded a sub-sample of 7,019 individuals corresponding to 25,697 person-years.[2] To assess the impact of the firm, I created a sub-sample containing 5,900 workers who stayed with the same employer and do not have missing data on firm characteristics. Finally, I constructed a sub-sample of 5,974 workers who stayed in the same occupational group (three-digit KldB 2010) and had no missing values on occupational characteristics to find out about the impact of occupations.

The dependent variable is log-transformed hourly gross labour income calculated using current labour income and actual work hours in the month prior to each interview. The main independent variable is participation in non-formal training courses. In the NEPS, respondents report for each job whether they participated in courses since the last interview.[3] Additionally, the interviewer asks for further courses during that period. Then, additional information is gathered for up to two randomly chosen courses out of the reported. However, a substantial number of respondents report more than two courses. To include these courses as well, I imputed the missing additional information using the chained equations routine in Stata 14 (StataCorp, 2015). The imputation was conducted in 'long format', i.e. individual courses nested within person-years constitute the cases.[4]

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The imputation model included course duration and categorized course content as well as total number of courses. Additionally, I included all individual-level information that is controlled for in the models as well as lags and leads of key variables in the imputation model. I generated 20 imputations and combined them using Rubin's rules in the analyses (Rubin, 1987).

I next calculated variables indicating total hours in training courses between the interviews from the imputed course data set. Courses have different combinations of characteristics. First, I differentiated between courses that the respondents reported to be work-related and those that they marked as private. Then, I separated work-related courses further into employer vs. worker-financed courses and employer-mandated vs. voluntary courses and calculated hours of training for the four possible combinations (see Table 1).[5]Supplementary Table A2 shows that participation in the course types does not correlate much, indicating that participation does not overlap. Then, I added up the hours spent in the different types of courses. Note that this operationalization does not distinguish between courses before and after wage growth. Due to data limitations, an analysis of the timing is only possible for a subset of courses and if respondents report a job change. I conduct the main analyses on data without timing information and then turn to the subgroup with timing information. Hours of training have been converted to weeks based on a 40-hour week. I assume that the effect of training on wages is permanent; therefore I sum up the weeks within individuals over time. I also include a squared term for each indicator in the models to account for diminishing returns to high volumes of additional training (Frazis and Loewenstein, 2005).

Employees who work in a firm with more than 100 employees or in the public sector and hold permanent contracts are considered as part of the ILM, although this definition includes both primary and secondary ILMs. Unfortunately I cannot differentiate the two on the basis of wage levels as Köhler *et al.* (2008) proposed because wage is also a dependent variable. Instead, I focus on the possibility of internal upward mobility because of long-term personnel policy, which is also a feature of primary ILMs. This is not measured directly in the NEPS. The closest proxy is the presence of

Table 1. Descriptive statistics of the samples

Variables (means)	Whole sample	Stay with firm			Stay in occupation
		All	ILM	Primary ILM	
Work-related courses, prevalence	0.39	0.39	0.45	0.5	0.39
Work-related courses, volume if participated (weeks)	0.46	0.46	0.56	0.63	0.46
Employer-financed mandatory courses, prevalence	0.19	0.19	0.23	0.26	0.19
Employer-financed mandatory courses, volume if participated (weeks)	0.13	0.13	0.17	0.2	0.13
Worker-financed mandatory courses, prevalence	0.01	0.01	0.01	0.01	0.01
Worker-financed mandatory courses, volume if participated (weeks)	0.01	0.02	0.01	0.02	0.02
Employer-financed voluntary courses, prevalence	0.25	0.25	0.3	0.34	0.25
Employer-financed voluntary courses, volume if participated (weeks)	0.23	0.22	0.29	0.33	0.23
Worker-financed voluntary courses, prevalence	0.06	0.06	0.07	0.06	0.06
Worker-financed voluntary courses, volume if participated (weeks)	0.09	0.09	0.09	0.08	0.09
Private courses, prevalence	0.14	0.14	0.15	0.15	0.14
Private courses, volume if participated (weeks)	0.21	0.21	0.21	0.2	0.21
Log hourly earnings	2.8	2.83	3	3.05	2.81
Tenure (months)	139.64	151.62	178.93	180.49	148.8
Work experience (months)	279.81	281.68	293.59	294.32	282.07
Weekly work hours	36.27	36.58	38.02	38.35	36.29
Years of education	14.2	14.21	14.53	14.61	14.21
Temporary contract, prevalence	0.06	0.04	0	0	0.05
Job change, prevalence	0.05	0.01	0.01	0.01	0.03
Household size	2.83	2.85	2.84	2.87	2.82
Number of children in the household	0.21	0.21	0.22	0.22	0.21
Gender: Woman	0.49	0.49	0.44	0.44	0.5
Age	47.13	47.18	47.82	47.88	47.31
N (person-years)	25,697	21,016	12,457	8,907	22,243

Source: NEPS SC6, own calculations.

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continuous planning of training in the firms assessed by asking 'Is there a regular further training plan in place for the workers?'. Because this indicator is self-reported by the employees, there may also be some degree of unreliability. For example, workers in weak positions within the firm may not know about training opportunities and are also less likely to profit from them. Therefore, this has to be interpreted with caution.

The presence of OLMs is measured through occupational closure. This is defined as the degree to which access to an occupation is restricted through credentials, certificates, or licences (Weeden, 2002). In Germany, occupational closure is often maintained through occupation-specific credentials such as those awarded after the occupation-specific dual vocational training system (Bol and Weeden, 2015). Thus, the share of individuals within an occupation who also hold a specific credential for this occupation is an indicator for occupational closure. To measure this, I use data from the BIBB/BAuA Employment Survey 2012 (Hall, Siefer and Tiemann, 2015). I calculated the percentage of matches between current occupation and credential within each three-digit occupational group (KldB 2010) for which the survey contained more than 25 observations. This was possible for 99 of the 141 occupational groups present in the NEPS. The calculated closure for each occupational group can be found in the Supplementary Table A1.

The estimation strategy to determine the returns to training considers selectivity of training. To this end, I use a fixed-effects (FE) specification, which removes unobserved time-constant and individual-specific heterogeneity. I further control for a set of time-changing covariates that are connected to wages, such as education, experience, and children in the household. Standard errors have been adjusted for clustering of observations within individuals and occupations. The FE approach depends on the common trends assumption. In the case of training participation this would be violated if training participation were selective on unobserved time-changing factors. For example, it could be that only those workers who are generally on an upward career track participate in training (Pischke, 2001). However, robustness checks indicate that participants have even slightly slower wage growth prior to training than comparable non-participants. The FE approach also controls for unobserved selection into the sample and attrition if the selection is based on individual-specific time-constant factors. Robustness checks using an indicator for attrition in the model showed no evidence for selectiveness on time-changing unobservables.

Table 1 summarizes the variables used in the analyses pooled over all waves. On average 39 per cent of the workers in the sample participate in job-related training per year. The courses amount about half a week per year on average. Distinguishing between types of courses, Table 1 indicates that employers finance most of these courses. Also, voluntary courses are more prevalent than mandatory courses. The table also shows that the sub-samples of workers who stayed in a firm or an occupation do not differ much from the original sample. This also implies that removing workers with missing information on occupational closure does not render the sample selective. However, a positive selection of workers is clearly demonstrated in ILMs and primary ILMs.

Results

To test the first three hypotheses, I consider the returns of different types of non-formal training regardless of the labour market segment. Model 1 in Table 2 distinguishes the four combinations of financing and voluntariness of work-related courses as well as private

Table 1. *The effect of non-formal training courses on log hourly wages. Fixed-effects model including year dummies and controls (omitted in table, see Supplementary Table A4)*

	(1)
Employer-financed mandatory	0.012*
	(0.0057)
Employer-financed mandatory squared	−0.00063*
	(0.00029)
Worker-financed mandatory	0.0016
	(0.022)
Worker-financed mandatory squared	−0.00017
	(0.0010)
Employer-financed voluntary	−0.0026
	(0.0037)
Employer-financed voluntary squared	0.00013
	(0.00020)
Worker-financed voluntary	−0.0023
	(0.0049)
Worker-financed voluntary squared	0.000095
	(0.00018)
Private	−0.0020
	(0.0019)
Private squared	0.000049
	(0.000046)
Years of education	0.040+
	(0.022)
Observations	25,697

$^{+}P < 0.10$, $^{*}P < 0.05$.

Standard errors in parentheses. Standard errors adjusted for clustering within individuals.

Source: NEPS SC6, own calculations.

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training. The results show that only employer-financed, mandatory training has a statistically significant positive coefficient. To interpret the coefficients, I make use of the approximation that small changes in log-transformed variables correspond to percentage changes if multiplied by 100. Accordingly, one week of employer-financed, mandatory training is associated with a 1 per cent increase in hourly wages. The squared term however indicates that there are decreasing additional returns as the number of weeks increase. Expressed as marginal effects in Figure 1, the contribution of an additional week after a worker already had 6 weeks of training amounts to only half of the initial coefficient. All of the other types of non-formal training courses show neither substantial nor significant associations with wages.

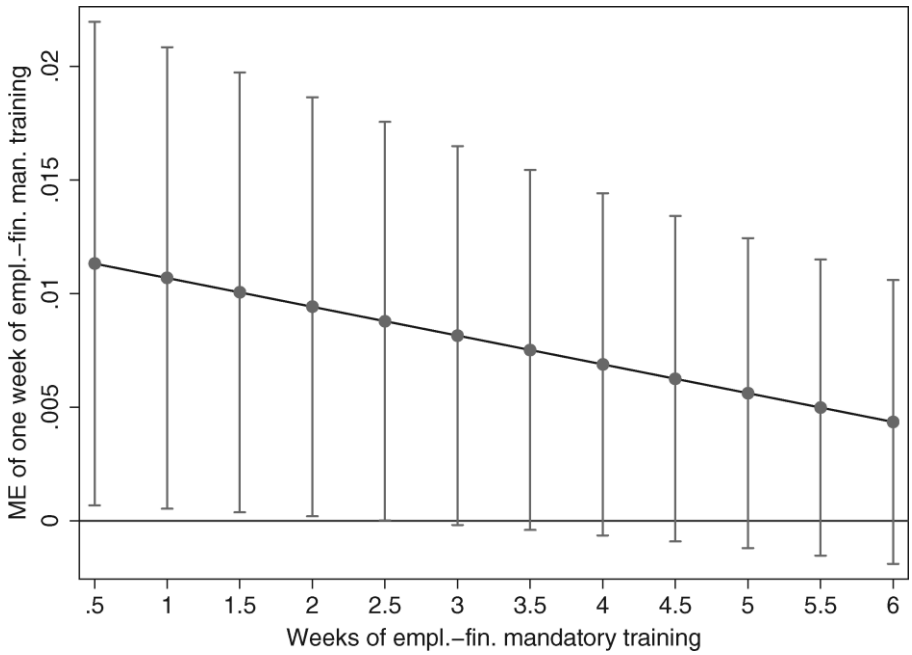
A 1 per cent increase in hourly wages due to 1 week of employer-financed, mandatory training is clearly a substantial influence on earnings trajectories. Earlier research reported increases between 2 and 4 per cent for a year of work-related training in Germany (Jürges and Schneider, 2006; Pischke, 2001). Also, the impact of employer-financed, mandatory training is high compared to the 4 per cent increase in wages due to another year of formal education presented in Table 2.

These results provide first evidence in favour of the Job Competition Model, which predicts that promotions and training are tightly linked. This suggests that employers choose workers to be promoted and then assign them to training for that job. In contrast, there is a lack of support for Hypotheses 1–3, which are derived from HCT and Signalling Theory. Neither private investment nor voluntary participation in training pays off.

Turning to mobility within firms, the results in Table 3 indicate that firm structure is important for the returns to further training. Table 3, Models 1 and 2, show the same specification as in Table 2 for those who stayed with a firm with an additional estimation for ILMs.[6] Results in Model 2 show that employer-financed, mandatory training yields substantial and significant returns in companies with an ILM. Without an ILM, no such returns can be observed. However, as Column 3 demonstrates, the difference between the types of firms is not statistically different from zero. Models 3 and 4 further distinguish between firms with primary and secondary ILMs. Results indicate that any advantages of workers associated with ILMs occur within primary ILMs. Again, this difference is not significant. The returns to all other types of training do not differ substantively between types of firms.

These results provide some evidence in favour of Hypothesis 4 derived from the Job Competition Model, as employer-mandated training shows the highest returns in primary ILMs, although the differences to other types of firms are not statistically significant.

Figure 1. *Marginal effects of employer-financed, mandatory training at different volumes of training with 95 per cent confidence intervals. Calculations based on Table 2*



Source: NEPS SC6, own calculations.

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Table 3. *The effect of non-formal training courses by presence of ILM. Fixed-effects models including year dummies and controls (omitted in table)*

	(1) No ILM	(2) ILM	Difference (2)–(1)	(3) Sec. ILM	(4) Pr. ILM	Difference (4)–(3)
Employer-financed mandatory	0.0021	0.017**	0.015	0.0081	0.019**	0.012
	(0.011)	(0.0059)	(0.012)	(0.015)	(0.0065)	(0.017)
Employer-financed mandatory squared	−0.00016	−0.00077*		−0.00029	−0.00089*	
	(0.00056)	(0.00034)		(0.0016)	(0.00037)	
Worker-financed mandatory	0.0085	−0.033	−0.04	−0.067	−0.015	0.052
	(0.052)	(0.045)	(0.073)	(0.065)	(0.070)	(0.1)
Worker-financed mandatory squared	−0.00046	0.0024		0.0052	0.0017	
	(0.0021)	(0.0043)		(0.0067)	(0.0062)	
Employer-financed voluntary	0.0016	0.0018	−0.0013	−0.012	0.0052	0.017
	(0.0087)	(0.0041)	(0.0093)	(0.0089)	(0.0046)	(0.01)
Employer-financed voluntary squared	−0.00012	−0.00015		0.00045	−0.00031	
	(0.00049)	(0.00023)		(0.00046)	(0.00025)	
Worker-financed voluntary	0.0039	−0.0054	−0.0094	−0.015	−0.00084	0.014
	(0.011)	(0.0060)	(0.012)	(0.012)	(0.0081)	(0.015)
Worker-financed voluntary squared	−0.000053	0.00015		0.00046	−0.000035	
	(0.00044)	(0.00024)		(0.00050)	(0.00037)	
Observations	8,559	12,457		3,550	8,907	

*$P < 0.05$, **$P < 0.01$.
Standard errors in parentheses. Standard errors adjusted for clustering within individuals.
Source: NEPS SC6, own calculations

Nevertheless, the associations between employer-financed, mandatory training and wages are only substantial and significant in primary ILMs. This can be tentatively interpreted as a sign for tight linkages between mandatory training and wage growth in large firms with long-term personnel policies.

The analyses thus far do not reveal the temporal order of training and wage growth, i.e. whether training precedes wage growth or follows it, as Hypothesis 5 derived from the Job Competition Model stated. Unfortunately, it is difficult to analyse this using the NEPS data, as described in the methods section. Nevertheless, Model 1 in Table 4 differentiates between courses that occurred before job changes from courses that occurred after. Model 2 additionally adds dummy variables for job changes and changes to a supervisory position to capture promotions. As with the previous models, I only use workers who stayed in a firm to identify firm-internal careers. For the sake of simplicity, I do not separate between types of ILMs in this analysis. The results are similar for all types.[7]

Table 4 shows that the inclusion of timing information does not change the results. Even when only focusing on courses that occur before job changes the association between employer-financed mandatory courses and wages remains substantive. The positive, yet non-significant, coefficient for training in the new job can be tentatively interpreted as a sign that courses after promotions matter. However, the coefficient shrinks when controlling for job change, indicating that internal job changes are associated with wage growth regardless of training. There are two possible explanations for this finding. Either employers send workers to courses before or while they promote them. Or the data on job mobility is not fine-grained enough to capture the process. Due to data limitations, this issue cannot be resolved in the present study.

Next, I compare the returns to training between open and closed occupations. Table 5 shows the same specifications as before, plus additional interactions with occupational closure for workers staying within an occupational group. Most interactions in Model 1 are negative, indicating lower returns in closed occupations. Again, only the interaction with employer-financed, mandatory training is statistically significant. Figure 2 plots marginal effects at different levels of occupational closure demonstrating that the returns to employer-financed, mandatory training are positive and significant in occupations in which less than 50 per cent of workers have an occupation-specific educational certificate. This association is no longer apparent for more highly closed occupations, i.e. where about 80 per cent have a corresponding educational certificate.

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	(1)	(2)
Employer-financed mandatory	0.023**	0.024**
	(0.0081)	(0.0081)
Employer-financed mandatory squared	−0.0011*	−0.0011*
	(0.00051)	(0.00051)
Employer-financed mandatory (new job)	0.033	−0.0000015
	(0.13)	(0.13)
Employer-financed mandatory (new job) squared	−0.035	−0.024
	(0.076)	(0.072)
Job change		0.020
		(0.018)
Supervisory position		0.028**
		(0.0088)
Observations	15,799	15,799

*$P < 0.05$, **$P < 0.01$.
Standard errors in parentheses. Standard errors adjusted for clustering within individuals.
Source: NEPS SC6, own calculations.

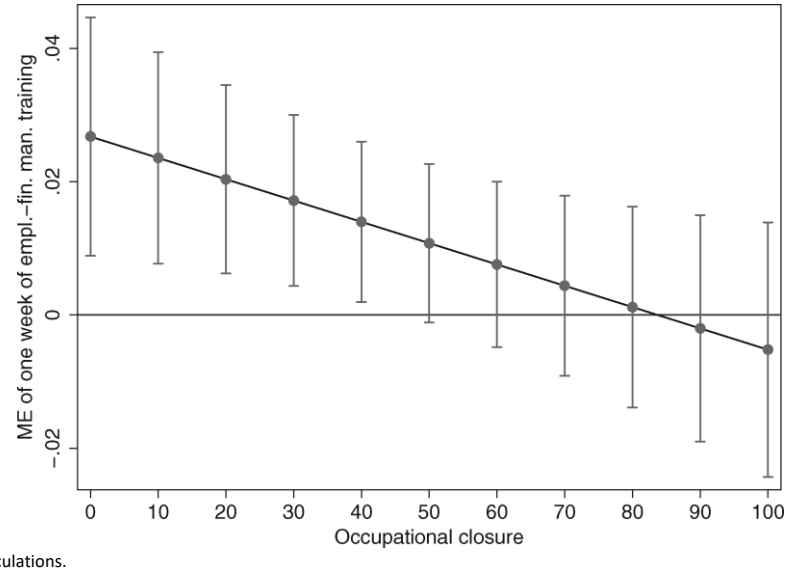
Table 4. *The effect of employer-financed, mandatory non-formal training courses on log hourly wages for workers staying in a firm separated by timing of training and controlled for job changes. Fixed-effects models including year dummies, controls, and other types of training (omitted in table)*

In line with Hypothesis 6, non-formal training does not yield returns in occupations that are closed through formal certificates. One explanation is that returns in these occupations rely primarily on formal credentials so that there is a high and uniform skill level. Hence, non-formal courses do not add enough to distinguish workers. Another explanation is high wage compression due to collective bargaining in these occupations. Unfortunately, these interpretations cannot be disentangled because there is no information about collective bargaining coverage in the data.

Finally, Models 3 and 4 in Table 5 jointly assess the impact of ILMs and OLMs. The data set now only contains workers who neither changed firm nor occupation. The similarity of the coefficients with those in Model 1 suggests that the differentiation of returns to training between occupations is orthogonal to the difference between firms. Even though the interaction effects of closure with employer-financed, mandatory training are not significant in Models 3 and 4, they show the same point estimate.

Overall, the results demonstrate that employer-mandated courses are the only type of non-formal further training that is substantially and significantly connected to wage growth. Yet, their returns depend on the context: Substantial wage growth due to these courses is

Figure 2. *Marginal Effects of employer-financed, mandatory training at different levels of occupational closure with 95 per cent confidence intervals. Calculations based on Model 1 in Table 5*



Source: NEPS SC6, own calculations.

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Table 5. *The effect of non-formal training courses on log hourly wages interacted with occupational closure. Fixed-effects models including year dummies controls and squared terms (omitted in table)*

	(1) All	(2) No ILM	(3) ILM	(4) Pr. ILM
Employer-financed mandatory	0.012*	−0.0074	0.018*	0.018^{+}
	(0.0060)	(0.010)	(0.0079)	(0.0094)
Employer-financed mandatory × closure	−0.00032*	−0.00028	−0.00029	−0.00031
	(0.00014)	(0.00036)	(0.00019)	(0.00024)
Worker-financed mandatory	−0.0070	0.090	−0.067	−0.053
	(0.036)	(0.12)	(0.11)	(0.20)
Worker-financed mandatory × closure	0.00078	0.0049	0.00067	−0.0021
	(0.0012)	(0.0055)	(0.0024)	(0.0045)
Employer-financed voluntary	0.0037	0.0052	−0.00022	0.0031
	(0.0036)	(0.011)	(0.0041)	(0.0045)
Employer-financed voluntary × closure	−0.00012	−0.00032	−0.000100	−0.00014
	(0.00011)	(0.00041)	(0.00014)	(0.00016)
Worker-financed voluntary	−0.000027	−0.0064	−0.0055	0.0021
	(0.0050)	(0.016)	(0.0067)	(0.012)
Worker-financed voluntary × closure	−0.000036	−0.00028	0.00012	0.00013
	(0.00014)	(0.00052)	(0.00020)	(0.00032)
Observations	22,243	6,996	11,462	8,228

$^{+}P < 0.10$, $^{*}P < 0.05$.
Standard errors in parentheses. Standard errors adjusted for clustering within occupations.
Source: NEPS SC6, own calculations.

only visible in primary ILMs and in open occupations. I interpret this as a confirmation of the Job Competition Model and the notion of Credentialism in certain occupations.

Nevertheless, there may be alternative explanations for the findings, which I will briefly explore in the remainder of this section. First, high returns to employer-mandated training may also be related to unobserved information about productivity and trainability that employers have about workers. Selection on these factors could bias the returns to mandatory training upwards. If trainability is a time-constant individual characteristic, the FE specification is sufficient to control for this bias. However, if it is individual-specific and time-changing it may bias the results. This might show up in steeper pre-training earning trajectories among those with training. Yet, I do not find evidence for this as indicated in the Methods section. Moreover, bias regarding which employees are selected for training should not differ across firms if firms are assumed to train the most trainable of employees. Therefore, it is plausible that the coefficient for employer-mandated training represents the effect of being selected for training compared to an otherwise similar worker who is not selected.

Secondly, mandatory courses can also differ in content, which may influence the extent of productivity increased by the training. However, Supplementary Table A3 shows that the content of employer-financed, mandatory training does not differ much from voluntary training.

Thirdly, jobs in information technology (IT) feature prominently amongst open occupations. Therefore the closure indicator may pick up other differences between occupations that are connected to returns to training. To explore this, I additionally calculated the percentage of workers in an occupation who state that they constantly need to learn new things in their job using the BIBB/BAuA data. This however does not correlate at all with closure indicating that this occurs both in open and closed occupations.

Discussion

Lifelong learning has become an integral part of employment careers as growing participation rates in further training courses indicate (Bilger *et al.*, 2013). In contrast to previous research that found few benefits of further training beyond job security (Dieckhoff, 2007; Dieckhoff, Jungblut and O'Connell, 2007), this study shows that returns vary depending on the organization of courses and the labour market context. This is in line

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with previous research demonstrating that the returns to education are context specific (Bol and van de Werfhorst, 2011; van de Werfhorst, 2011; Vogtenhuber, 2015).

Indeed, monetary returns do not depend on individual decisions to invest in non-formal training but instead on the firms and occupations they occur in. Training measures that workers were selected for by their employers are most strongly associated with wage increases. This association is strengthened in large firms that feature long-term personnel development policies, so called primary ILMs (Köhler *et al.*, 2008). Moreover, even within such firms, returns are higher in open occupations, which do not require occupation-specific credentials. This finding aligns with Thurow's (1975) Job Competition Model and the notion of Credentialism (Collins, 1979). Thurow's model emphasizes the role of employers in selecting workers for promotion and training. Credentialism pointed to the impact of non-formal further training in open occupations because formal credentials are less important in this context (Haupt, 2012).

The results clearly speak against hypotheses derived from different versions of HCT. This framework would neither predict a higher association with employer-mandated training in large firms nor a lower association in closed occupations. Nevertheless, the analyses also cannot completely ascertain that the proposed mechanisms are the reasons for the results. Even though the robustness checks were generally in line with the predictions, there was no evidence for the importance of courses after promotions, as predicted by the Job Competition Model. However, this may be related to the coarseness of the data.

Together, the results indicate that firms are important gatekeepers for wage growth due to lifelong learning in Germany. Non-formal further training courses, which are by far the most common type of lifelong learning, only benefit selected workers within firm-internal careers. This is in line with previous research highlighting the role of employers for further training (O'Connell and Byrne, 2012; Wotschack and Solga, 2014). One remaining question is whether this finding is specific to the German context, where firms play a crucial role in providing further training. Also, formal credentials are important in Germany, which is apparently confining the impact of non-formal training. Thus, findings may be specific to countries like Germany where vocational credentials are an important source for closure (Bol and Weeden, 2015). Nonetheless, a tight coupling between employer-mandated training and promotions reflected in ILMs is extremely likely to extend beyond the case of Germany. Further research is indicated to ascertain this.

To extend from previous research on the returns to training, this study showed that a more nuanced perspective requires attention to the organization of training and labour market context. Such a perspective is better suited to find out who benefits from training and who does not. Thereby, the findings further the debate about the returns to further training in Germany and beyond, which has often only discussed the general presence or absence of returns.

Notes

1. I excluded the retrospective component of the data as well as data from the NEPS's predecessor Arbeiten und Lernen im Wandel (ALWA) because data on wages and training courses are not comparable to the prospective part of the survey.
2. Of the 17,139 individuals in the NEPS SC6, 4,778 were removed because they are never in dependent employment during the panel waves. Further 566 were removed because of missing data. The main reason for missing data is non-response on earnings. Since this is the dependent variable, I do not impute the cases because this would not provide additional information for the models (Von Hippel, 2007). Finally, 4,578 individuals could not be used for the longitudinal analysis because they were only present or employed for one wave.
3. Up to three courses are recorded for each employment spell per interview. Since many workers report more than three courses, I generated up to two additional courses per job using information about the total number of courses and the time spent on training.
4. Imputation in 'wide format' was not feasible because the models did not converge due to the large number of variables as some workers reported more than 10 courses within a year. Yet, simulations suggest that imputation in long format also yields valid results (Young and Johnson, 2015). The imputation on the course level has the downside that imputed values for the other variables in the model could not be used because they vary within person-years.
5. Courses could also be mandated by someone else than the employer. These courses however are very rare and therefore omitted.
6. The exclusion of firm-changers may introduce downward bias to the estimates if highly motivated workers change to firms that provide more

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training and upward career possibilities. Yet, because of the short length of the panel, the low number of job changers, and the control for time-constant aspects of motivation in the FE approach the bias is presumably not large.

7. Note that the number of cases differs between Tables 3 and 4. This occurs because I could only use individuals who have been in employment for at least three waves to get at the timing of the courses. This and the omission of courses without timing information lead to different point estimates for employer-financed, mandatory training compared to Table 3.

Supplementary Data

Supplementary data are available at ESR online.

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